

## What is Claimed Is:

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 A1 1. A method of classifying a defect on the surface of an article,  
 which method comprises:  
 imaging the surface to form a defect image;  
 classifying the defect as being in one of a predetermined number of  
 5 core classes of defects using a core classifier; and  
 classifying the defect as being in one of an arbitrary number of variant  
 subclasses using a specific adaptive classifier associated with the one core  
 class.
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 C1 2. The method according to claim 1, comprising classifying the  
 defect as being in one of an arbitrary number of variant classes using a full  
 classifier when the core classifier cannot classify the defect into one of the  
 core classes.
3. The method according to claim 1, wherein the core classes of  
 defects comprise a pattern defect and a particle defect.
4. The method according to claim 3, wherein the core classes of  
 defects comprise a missing pattern on the surface, an extra pattern on the  
 surface, a particle on the surface, a particle embedded in the surface, and  
 microscratches on the surface.
5. The method according to claim 4, wherein the variant  
 subclasses of defects comprise a particle of a predetermined size on the  
 surface or embedded in the surface.
6. The method according to claim 1, comprising providing a  
 plurality of specific adaptive classifiers, each being associated with less than  
 the predetermined number of core classes.
7. The method according to claim 1, comprising performing a  
 boundary analysis of the defect image, a topographical analysis of the defect  
 image, or both to classify the defect into the one core class.

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training the specific adaptive classifier to identify defects of the variant subclass based on an exemplary set of known predicates of defects of the variant subclass; and

9. The method according to claim 8, comprising training the specific adaptive classifier using decision tree or multidimensional clustering techniques.

an imager to produce an image of the defect; and  
a processor comprising:

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C1 7 11. The apparatus according to claim 10, wherein the processor further comprises a full classifier for classifying the defect as being in one of an arbitrary number of variant classes when the core classifier cannot classify the defect into one of the core classes.

12. The apparatus according to claim 10, wherein the core classes of defects comprise a pattern defect or a particle defect.

13. The apparatus according to claim 12, wherein the core classes of defects comprise a missing pattern on the surface, an extra pattern on the surface, a particle on the surface, a particle embedded in the surface, and microscratches on the surface.

14. The apparatus according to claim 13, wherein the variant subclasses of defects comprise a particle of a predetermined size on the surface or embedded in the surface.

15. The apparatus according to claim 10, comprising a plurality of specific adaptive classifiers, each being associated with less than the predetermined number of core classes.

16. The apparatus according to claim 10, wherein the processor is further configured to perform a boundary analysis of the defect image, a topographical analysis of the defect image, or both to classify the defect into the one core class.

17. The apparatus according to claim 16, wherein the specific adaptive classifier is trainable to identify defects of the variant subclass based on an exemplary set of known predicates of defects of the variant subclass; and

5 wherein the specific adaptive classifier is for analyzing predicates associated with the defect image to classify the defect into one of the variant subclasses.

18. The method according to claim 17, wherein the specific adaptive classifier is trainable using decision tree or multidimensional clustering techniques.

Sub 19. A specific adaptive classifier for classifying a defect on the surface of an article as being in one of an arbitrary number of variant subclasses of a core defect class, responsive to a core classifier classifying the defect as being in the core class.

20. The specific adaptive classifier of claim 19, wherein the specific adaptive classifier is trainable to identify defects of the variant subclass based on an exemplary set of known predicates of defects of the variant subclass; and

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- 5 wherein the specific adaptive classifier is for analyzing predicates associated with an image of the defect to classify the defect into one of the variant subclasses.

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C17 21. The specific adaptive classifier of claim 20, wherein the specific adaptive classifier is trainable using decision tree or multidimensional clustering techniques.

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A4 22. A computer-readable medium bearing instructions for automatically classifying a defect on the surface of an article, said instructions, when executed, being arranged to cause one or more processors to perform the steps of:

- 5 imaging the surface to form a defect image;  
classifying the defect as being in one of a predetermined number of core classes of defects; and  
classifying the defect as being in one of an arbitrary number of variant subclasses based on the classification of the defect as being in the one core  
10 class.

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C17 23. The computer-readable medium according to claim 22, wherein the instructions, when executed, are arranged to cause the one or more processors to perform the step of classifying the defect as being in one of an arbitrary number of variant classes when the one or more processors cannot  
5 classify the defect into one of the core classes.

24. The computer-readable medium according to claim 22, wherein the core classes of defects comprise a pattern defect and a particle defect.

25. The computer-readable medium according to claim 24, wherein the core classes of defects comprise a missing pattern on the surface, an extra pattern on the surface, a particle on the surface, a particle embedded in the surface, and microscratches on the surface.

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27. The computer-readable medium according to claim 22, wherein the instructions, when executed, are arranged to cause the one or more processors to perform a boundary analysis of the defect image, a topographical analysis of the defect image, or both to classify the defect into the one core class.

learning to identify defects of the variant subclass based on an  
5 exemplary set of known predicates of defects of the variant subclass; and  
analyzing predicates associated with the defect image to classify the  
defect into one of the variant subclasses.

30. The computer-readable medium according to claim 22, wherein the instructions, when executed, are arranged to cause the one or more processors to perform the step of imaging the surface with a scanning electron microscope.